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the surface contained few Entomostraca, but these increased at this level during the night, the Copepoda appearing before the Cladocera, the maximum being attained at 4 A.M. The night catches at the surface and at 20 meters contained great numbers of Ceratium in division. Migration, reproduction, and growth are all factors in this increase in the nocturnal plankton in the superficial layers. No report is made upon the total vertical content of the water, and the data do not afford any clue to the extent of the migration suggested. The position of the thermocline is not indicated.

C. A. K.

Plankton of the Oder.[1] — This potamoplankton is characterized by Schröder as variable, being at a minimum during the winter when the stream is frozen, and in March when it is at flood and full of silt. It attains a maximum during a period of low water in the latter part of the summer. The plankton of the main current is less abundant than that of contiguous bays or of adjacent ponds supplied by the river. It is suggested that the plankton content of flowing water is inversely proportional to the fall of the stream. At all times the phytoplankton of the Oder is relatively small, and is largely composed of diatoms. In the shallower and warmer water of the ponds the Bacillariaceæ are replaced by the Chlorophyceæ and Phytomastigophora. Thus, in general, the diatoms thrive best in cooler water, as in mountain lakes and cold streams, while shade and access of running water favor their development in ponds. In the plankton of the Atlantic Ocean, also, the diatoms predominate in the arctic waters, and are replaced by the Peridinidæ and Schizophyceæ in warmer regions.

C. A. K.

Notes on Nematode Parasites. — 1. It is not often that one is called upon to record valuable contributions to zoölogical literature from the pen of a botanist, but the recently published work of Stone and Smith[2] on nematodes is deserving of more than passing notice. The root-galls produced by certain species of this group are the cause of considerable damage among cultivated plants, and the authors, who were drawn to investigate the subject by reason of its economic importance and bearing on their own department, have given it a very complete study. From the large amount of valuable matter a few points of especial interest may be selected.

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[1] Schröder, B. Planktologische Mitteilungen, *Biol. Centralb.*, Bd. xviii (1898), pp. 525–535.

[2] Stone, Geo. E., and Smith, Ralph E. Nematode Worms, *Division of Botany, Bull. No. 55, Hatch Experiment Station Mass. Agr. College* (November, 1898). 67 pp., 12 plates.

After discussing the economic importance of the question, the structure of nematode worms and the symptoms of their attack, there follows a careful description of the root-gall, in which it is shown that the worms affect the plants, not directly by extracting nutriment, but indirectly by modifying the structure of the root so that the flow of sap is interfered with, and secondarily by weakening it so that it is more susceptible to other diseases. The structure and development of *Heterodera*, the gall nematode, are fully described; and in connection with a careful review of the literature the authors maintain the identity of the German species with that found by Cobb in Australia, that studied by Neal and Atkinson in the southern United States, and that on which they worked themselves in Massachusetts. Although carefully reached, the conclusion is still open to question. The nematodes display great uniformity in general structure, and species are at best often very difficult to distinguish. It is not clear that the lips, together with the oral and caudal papillæ, were examined in all these forms; but these are the characters at present accepted as the most reliable for specific determination. And while specimens of the German form were compared with the Massachusetts variety, it was only the female, while on the analogy of other species in this group the male alone would suffice for specific determination. Furthermore, in some points at least, the habits of the two forms are not in agreement, so that the specific identity can hardly be regarded as established.

The authors have discussed very completely the various methods of treatment for nematode root-galls, and have experimented in detail with most of them. They reach the conclusion that "the most effectual, complete, and practical method of exterminating nematodes in greenhouses is by heating the soil by means of steam," which is both comparatively inexpensive and noticeably beneficial to the soil. While experimenting they noticed the comparative indifference of *Heterodera* to an atmosphere strong in CO_2. This is interesting as confirming for one free living representative of the group what Bunge long ago demonstrated for certain parasitic species. The paper is well illustrated and of permanent value.

2. A good résumé of present knowledge on the nematodes has recently appeared in the form of a somewhat popular article,[1] which

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[1] Cobb, N. A. Extract from Manuscript Report on the Parasites of Stock, *Miscell. Publ. Dept. of Agr. Sidney*, *N. S. W.*, No. 215; also from *Agr. Gazette N. S. W.* (March and April, 1898), 62 pp., 129 text-figures.

contains also noteworthy contributions from the work of the author. The reader is struck at the outset by the breezy character of the author's style, especially noticeable in the first part of the paper on the methods of manipulation, which contains an energetic appeal to study of the group by a wider circle and full directions for carrying on the work. In the second part the anatomy and physiology of these worms are discussed topically under the various systems. Among the more important points which are new may be mentioned a tabulation of the various forms assumed by the pharynx and œsophagus, together with a terminology for the same. Microchemical demonstration of different uric compounds in preparations of the lateral fields strengthens the belief that the ducts in them are associated with the excretory function.[1] The author argues for a respiratory function of the problematical "lateral organs" present in varying form and development in all (?) the free-living forms, but wanting in the parasitic species, and gives some personal observations on the structure of these little known organs in new members of the group. Various hints make it evident that the author has some radical improvements to suggest on the classification of the nematodes. It is to be hoped that they may be published soon, as the present confusion in the group is exceedingly unfortunate for all students.

The article is illustrated by numerous exceedingly well made woodcuts which represent in many cases new species unaccompanied by any further description than the formula after the fashion set by the author for nematodes, yet the advantage of accurate figures is at once evident. Though the cuts are small and somewhat difficult to decipher, they are very exact, and it is agreeable to see illustrations which are new and which represent the real conditions rather than the author's diagrammatic conception of structure; were these figures only a little larger and more distinct they would be ideal.

H. B. W.

Origin and Development of Sense Organs. — Three popular scientific lectures on the origin and development of sense organs and sensory activities in the animal kingdom have been given by Dr. P. Steffan before the Senckenbergian Natural History Society.[2] In his intro-

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[1] The recent researches of Nassonow, *et alii*, have appeared since the publication of the article.

[2] Steffan, P. Entstehung und Entwickelung der Sinnesorgane und Sinnesthätigkeiten im Tierreiche, *Ber. Senckenb. Naturf. Gesell.*, Frankfort a/M. (1898), pp. 29–69.